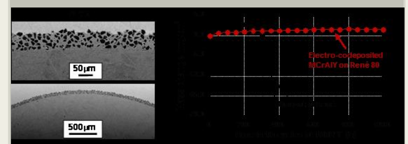
Low Cost Corrosion and Oxidation Resistant Coatings for Improved System Reliability, Phase I

Completed Technology Project (2017 - 2017)

Project Introduction

In order to improve high-temperature oxidation and corrosion resistance of critical superalloy components in turbine engines innovative processing methods must be devised to improve coating and materials properties at a higher reliability and lower costs. Whether or not thermal barrier coating are applied to the engine components, the resistance to oxidation and hot corrosion relies on metallic coatings protecting the superalloy substrate. These metallic coatings are commonly either diffusion aluminides or MCrAlY overlays (where M=Ni, Co, Fe, Ni+Co, etc). Compared with diffusion coatings, MCrAlY coatings are more flexible in terms of composition selection for achieving a more balanced combination of coating properties and having a lower ductile to brittle transition temperature, which makes them more resistant to cracking upon thermal cycling. Several techniques have been developed to deposit MCrAlY coatings including physical vapor deposition, electrolytic codeposition, electrophoresis, and autocatalytic electroless deposition, of which electrolytic codeposition appears to be a promising, low cost, non-line of sight approach. Therefore, the overall objective of the Phase I and II programs is to create a scalable cost effective process to produce coatings that can enhance high temperature reliability and corrosion/oxidation and erosion resistance. This program will build off of Dr. Ying Zhang (Tennessee Technological University) electrolytic codeposition work and Faraday Technology's alloy coating development efforts to create a scalable process to electrolytic codeposit MCrAlY onto engine shaped components and to investigate other potential MCrAlX alloy elements that could further increase the coatings temperature resistance. If successful this program has the potential to greatly improve the oxidation and corrosion resistance of metallic coatings while also improving their reliability at higher operating temperatures and reducing their manufacturing costs.



Low cost corrosion and oxidation resistant coatings for improved system reliability, Phase I Briefing Chart Image

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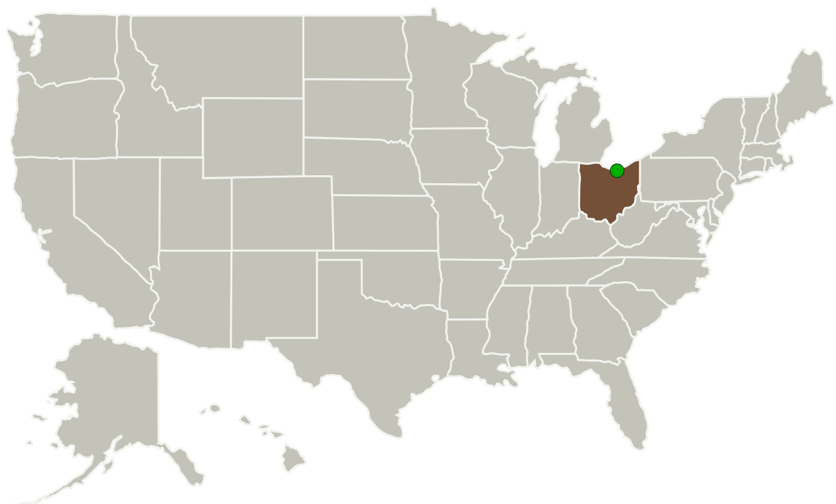
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Faraday Technology, Inc	Lead Organization	Industry	Clayton, Ohio
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations
Ohio

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Faraday Technology, Inc

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

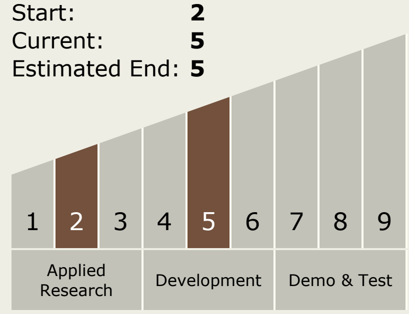
Carlos Torrez

Principal Investigator:

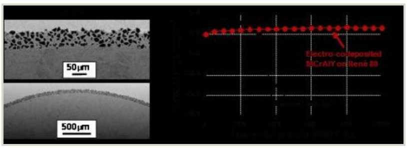
Timothy D Hall

Technology Maturity (TRL)

Start: **2**
Current: **5**
Estimated End: **5**



Images



Briefing Chart Image
Low cost corrosion and oxidation resistant coatings for improved system reliability, Phase I Briefing Chart Image
(https://techport.nasa.gov/image/135138)

Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  └ TX12.1 Materials
    └ TX12.1.5 Coatings

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System